Interim Geologic Map of the San Rafael Desert 30' x 60' Quadrangle, Emery and Grand Counties, Utah

by

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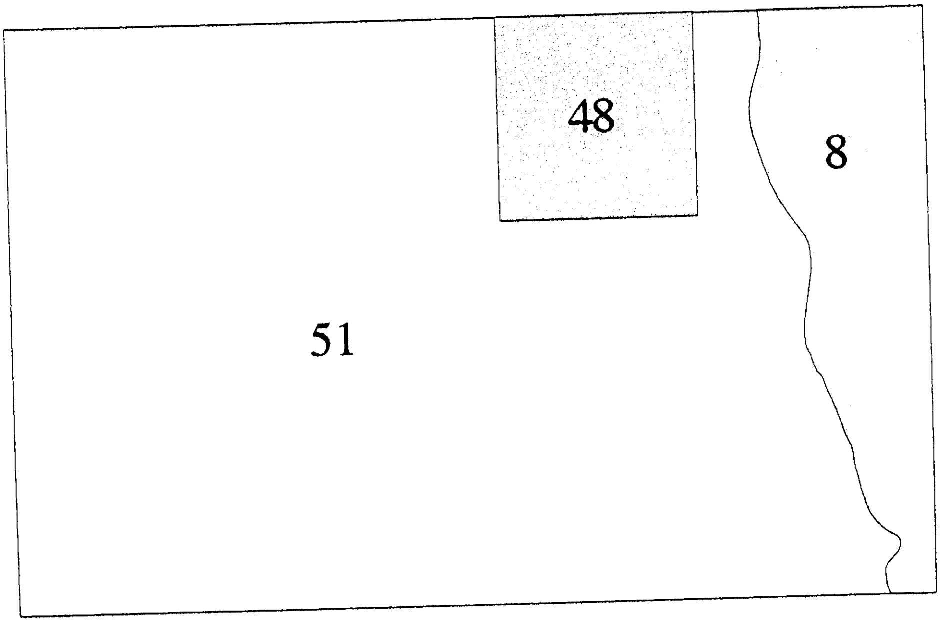

Figure 1. Map sources used in production of the San Rafael Desert 30'x60 quadrangle geologic map. Numbers 8 and 48 refer to bibliography. Number 51 represents original mapping by the author and compiler. Other sources listed in the bibliography were preempted by new field mapping for this project.

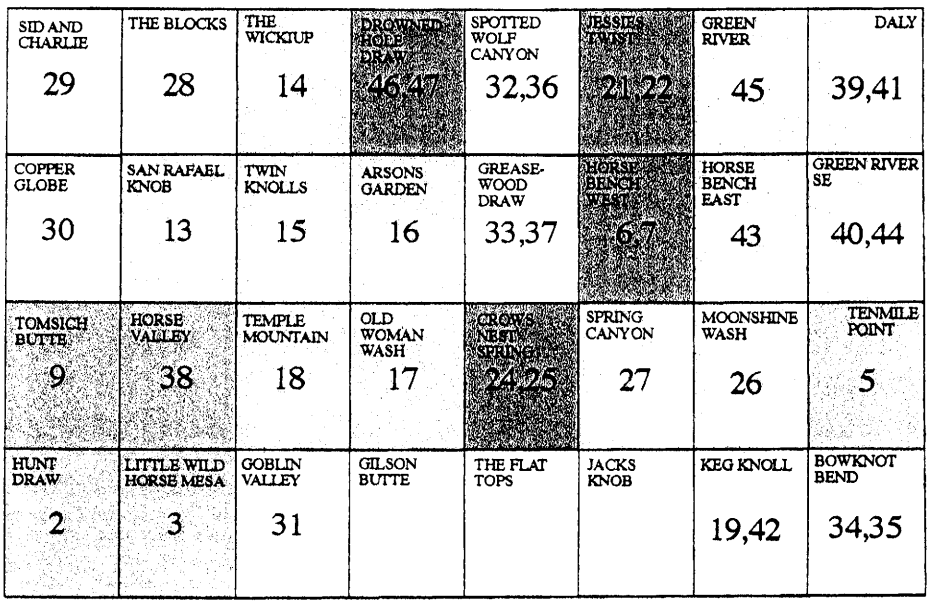

Figure 2. Index to 1:24,000 photogeologic maps available for the San Rafael Desert 30'x60' quadrangle. Numbers refer to bibliography.

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DESCRIPTION OF MAP UNITS

Quaternary Deposits

Map unit	Description
Qfd	**Fill and disturbed areas:** Gypsum, crushed stone, and road fill quarries; and stockpiles of road fill and asphalt.
Qa (Qa1, Qa2, Qa3)	**Stream and wash alluvium:** Sand, silt, clay, granules, pebbles and sparse cobbles adjacent to more active streams and washes; unconsolidated, poorly to well-sorted channel-fill (Qal) and low-level terrace deposits (Qa2 and Qa3); Qa3 deposits are older and higher above the modern stream course than Qa2 deposits; all mapped as Qa where undifferentiated. Thickness varies widely, but commonly less than 10 meters (33 ft) thick. Holocene.
Qat	**Terrace alluvium**: Mostly silt to cobbles, angular to rounded; contains chert, limestone, sandstone, siltstone, dolomite, and petrified wood gravel to 0.6 m (2 ft) or more in diameter, but mostly pebbles to cobbles up to 5 centimeters (2 in) in diameter; basal parts are generally more coarse; commonly partly to fully consolidated in basal parts with cementing calcium carbonate (caliche), especially in the higher deposits; cement is locally as thick as 3.5 meters (12 ft); deposits are found at irregular levels to as high as 183 m (600 ft) above modern drainages. Exotic gravels are derived from units in the Book Cliffs (Green River terraces) and the San Rafael Swell (San Rafael River and larger intermittent drainages). 0 to 10 meters (0-30 ft) thick. Holocene and Pleistocene.
Qap	**Pediment-mantle deposits:** Poorly to moderately sorted, rounded to angular boulders, cobbles, pebbles, granules, sand, silt, and clay; covers bedrock surfaces between drainages as high as 120 meters (400 ft) above local base level. Commonly less than 10 meters (33 ft thick). Mostly upper Pleistocene.
Qea	**Mixed wind-blown sand and alluvium:** Sand and silt of eolian origin interspersed with silt, sand, and gravel of fluvial origin; generally dominated by eolian deposits; commonly displays a well-developed caliche soil horizon at the top. Thickness 15 meters (50 ft) or less. Holocene to middle Pleistocene.
Qmt	**Talus and colluvium:** Rock-fall blocks, boulders, smaller angular gravel, sand, and silt; deposited on slopes below cliffs and steep slopes; only larger deposits mapped. Thickness generally 4.5 meters (15 ft) or less. Holocene to upper Pleistocene.
Qms	**Landslides and slumps:** Coherent to broken and jumbled masses of bedrock that have moved downslope due to gravity; most commonly associated with the Jurassic Morrison Formation. Varied thicknesses. Holocene to upper Pleistocene.
Qaf	**Alluvial-fan deposits:** Poorly sorted, angular to subrounded gravel, containing cobbles and sparse boulders, in crudely bedded to unstratified granules, sand, silt, and clay matrix; cut-and-fill channel features locally present; deposited at the foot of mountains, cliffs, and at the mouths of streams and washes. Thickness commonly less than 15 meters (50 ft) Holocene to upper Pleistocene.
Ql	**Lacustrine deposits:** Thin silt and sand deposits in dried-up reservoir areas and in playas. Thickness mostly less than 1 meter (3 ft). Holocene.
Qst	**Tufa deposits:** Mostly drab, light yellow-gray, calcareous tufa (travertine), some yellow ocher to dusky red brown, porous, crudely laminated, locally thin bedded; weathers in plates and platelets; formed by cold-water springs and geysers. Thickness as much as 7.5 meters (25 ft). Holocene to middle Pleistocene.
Qes	**Wind-blown sand:** Unconsolidated sand deposited in sheets, nearly white to light-brown, but generally light orange-brown or tan, fine to medium grained, commonly covers Qea, Qa, Qat, Qap, and bedrock units. Especially extensive in areas underlain by Je,

Jee, Jes, and adjacent deposits. Locally interlensed with Qa deposits. Contains small areas of dune deposits, especially longitudinal dunes trending northeast in response to prevailing winds. 0 to 4.5 meters (0-15 ft) thick. Holocene to Upper Pleistocene.

Qed

Wind-blown dune sand: Fine- to medium-grained sand that forms dunes and mounds; generally light orange brown or tan, upper surfaces commonly rippled, commonly covers Qes, Qea, Qa, Qat, Qap and bedrock; mapped only where present in larger areas, mostly on the lee side of small escarpments, cliffs, etc.; deposits extend northeasterly in response to prevailing winds. 0 to 15 meters (0-50 ft) thick. Mostly Holocene in age.

Bedrock Units

Tertiary Rocks

Td

Lamproite dikes: Dark-gray igneous rock with abundant phlogopite, olivine, and carbonate mafic mineral pseudomorph phenocrysts and vesicle fillings in a phlogopite-rich, microcrystalline matrix that contains small percentages of sanidine, apatite, hematite, and magnetite. 0 to 1 meter (0-3 ft) thick dikes intruded into Middle Jurassic Entrada Sandstone. Miocene (22 + 0.2 Ma [Hulen and others, 1997]).

Cretaceous Rocks

Km

Mancos Shale (on cross sections only): Members as described below.

Kmb

Blue Gate Shale Member: Mostly light- to dark-gray, thinly laminated to medium-bedded shale and shaly siltstone with sparse interlayered thin yellow-brown to yellow-gray sandstone beds; forms low rounded hills and flat plains; deposited in shallow marine environment; lower contact with the Ferron Sandstone Member is gradational. 800 to 1,000 m (2,600-3,300 ft) thick; but only the lower part is exposed in the quadrangle. Campanian to Turonian.

Kmfu

Kmfl

Ferron Sandstone Member: Brown-gray to yellow-gray, marine, fine-grained, cross-bedded sandstone, sandy mudstone, and carbonaceous shale; fissile to medium bedded and even bedded; commonly forms two sandstone cuestas with intervening slope of light-gray to black carbonaceous shale and shaly siltstone (included with Kmfu); locally fossiliferous; deposited in shallow marine environment; lower contact is a subtle scour surface locally overlain by lenticular lag deposits of pebbly, medium to coarse-grained sandstone. 15 to 50 meters (50-165 ft) thick. Turonian.

Kmtc

Kmt

Tununk Shale Member: Light- to dark-gray, marine shale, shaly siltstone, or mudstone; contains fine-grained pale-yellow sandy zones, especially near the top; forms slopes and low rounded hills; lower contact with Dakota is abrupt but conformable; locally contains the Coon Springs Bed (Kmtc) in the upper third of the unit--a conspicuous zone of sandy, fossiliferous, concretionary limestone or calcareous sandstone; locally contains discontinuous ledges of silicified shale; lower contact is a disconformity where the Dakota is missing, marked by a change from gray-green (Cedar Mountain Formation) to gray shale; a zone of fossils (*Gryphaea newberryi* Stanton) is found a few feet above the contact. 90 to 130 meters (300-430 ft), generally thickening to the west. Turonian to Cenomanian.

Kdcm

Dakota-Cedar Mountain Formations, undivided (on cross sections only): As described below.

Kd

Dakota Sandstone: Light-yellow and yellow-brown, friable to quartzitic, coarse-grained, cross-bedded fluvial sandstone, conglomeratic sandstone, and conglomerate, with minor interbedded carbonaceous shale and impure coal; quartzite and chert pebbles as much as 2.5 centimeters (1 in) in diameter; locally contains silicified wood and plant impressions; yellow, iron-stained bands or streaks present along some cross-beds; forms isolated ridges and mounds; discontinuous and commonly missing. 0 to 9 meters (0-30 ft) thick. Cenomanian.

unconformity

Kcm

Cedar Mountain Formation: Variegated pale-gray, lavender, and pastel purple, red, and green mudstone, siltstone, and shale, commonly bentonitic; contains several zones of brown, nodular limestone, especially near the base; contains sparse gray, green, or light-brown thin-bedded, lenticular, fine-grained sandstone beds; forms gentle to steep-sloped badlands devoid of vegetation; the Buckhorn Conglomerate is present at the base of the formation in the north part of the mapped area which is dark-brown fluvial and cross-bedded conglomerate, conglomeratic sandstone, and sandstone that forms a cliff or ledge containing mostly white quartzite and black and light-brown chert pebbles and cobbles, and is thick-bedded to massive; the Buckhorn locally contains logs and branches of petrified wood; the lower contact with the Morrison Formation is a disconformity. 22 to 58 meters (75-190 ft) thick; Buckhorn Conglomerate is 0 to 9 meters (0-30 ft) thick. Albian.

K-O unconformity

Jurassic Rocks

Jm

Morrison Formation (on cross sections only): Members as described below.

Jmb

Brushy Basin Member: Well-banded, variegated (purple, green, yellow, maroon, white) siltstone, claystone, mudstone, and shale, interbedded with minor brown and gray nodular limestone beds and white, gray, and light-brown cross-bedded sandstone lenses; contains a few ledgy conglomeratic sandstones at base; generally forms steep slopes devoid of vegetation; beds are commonly bentonitic; lower contact is placed at base of the mudstone sequence or at the base of the lowest conglomerate ledge. 45 to 130 meters (150-425 ft) thick. Tithonian (Upper Jurassic).

Jms

Salt Wash Member: Red and gray mudstone and siltstone interbedded with light-yellow-gray lenticular sandstone; mudstone and siltstone forms slopes and recesses between sandstone lenses; sandstone lenses thicken and coarsen upward in the unit; upper lenses are commonly coarse-grained, trough cross-bedded, and locally contain vanadium and uranium minerals; lenses are channel deposits; southern exposures generally contain more sandstone than mudstone; also contains thin sandy limestone beds, especially in the lower parts of the member; lower contact is placed at the base of the lowest obvious sandstone lens in the member. 45 to 90 meters (150-300 ft.) thick. Kimmeridgian (Upper Jurassic).

Jmt

Tidwell Member: Lavender, maroon, and light-gray thin-bedded calcareous siltstone and marl, interbedded with very fine-grained sandstone and gray thin-bedded or nodular-weathering limestone; mostly slope forming; locally contains a thick gypsum bed as much as 5 meters (15 ft) thick at the base; lower contact is a disconformity. 6 to 15 meters (20-50 ft) thick; may locally be thicker. Kimmeridgian and Oxfordian (Upper Jurassic).

J-5 unconformity

Jsr

San Rafael Group: Summerville, Curtis, Entrada, and Carmel Formations, undivided (on cross sections only): As described below.

Js

Summerville Formation: Thin, even-bedded, red-brown siltstone, sandstone, and gypsum, interbedded with minor limestone, and shale; forms local steep slopes or vertical cliffs and locally forms earthy slopes; sandstone is generally fine-grained and weathers platy; limestone is gray, crystalline, and nodular; gypsum is present in veinlets, thin beds, and nodule zones; jasper is present near the top; lower contact is gradational with the Curtis Formation. 30 to 120 meters (100-400 ft) thick. Callovian (Middle Jurassic).

Jct

Curtis Formation: Green-gray to brown fine- to coarse-grained sandstone and green-gray to red shale, becomes mostly red-brown east of the Green River; glauconitic; locally contains red, white, and clear siliceous nodules; lower part cliff-forming, upper part forms slope and grades into Summerville Formation above; zone of limestone beds containing jasper occurs about 1.5 to 3 meters (5-10 ft) below the Summerville contact; unit is locally saturated with asphalt. 9 to 75 meters (30-250 ft) thick. Callovian (Middle Jurassic).

J-3 unconformity

Je

Entrada Sandstone, undivided: Red-brown silty, very-fine-grained sandstone, alternating with yellow-gray to orange-brown massive sandstone in the San Rafael Desert; west of the San Rafael Swell, red-brown silty rocks dominate; in northeast part of quadrangle two members are identifiable; an earthy member (Jee) and the Slick Rock Member (Jes). 76 to 160 meters (250-530 ft) thick in the San Rafael Desert and south part of quadrangle; is nearly 245 meters (800 ft) thick to the northwest. Callovian (Middle Jurassic).

Jee

Earthy member: Mostly red-brown, silty, very-fine-grained sandstone at the top of the formation; only mappable in the northeast corner of the quadrangle. 18 to 46 meters (60-150 ft) thick.

Jes

Slick Rock Member: Orange-brown, massive, cross-bedded sandstone, sometimes referred to as "slick rim" sandstone; only mappable in the northeast corner of the quadrangle. 45 to 91 meters (150-300 ft) thick.

Jc

Carmel Formation, undivided (mapped as such only along part of San Rafael Reef): Members as described below. Callovian to Bajocian (Middle Jurassic).

Jcu

Upper member (Winsor Member): Red and green, sandy siltstone and shale interbedded with alabaster gypsum beds; generally forms slopes with gypsum beds forming ledges; red beds dominate at base and at top; in southeast corner of quadrangle the unit becomes thin and loses gypsum beds and grades into the Dewey Bridge Member; muddy, dark-red, earthy, fine-grained sandstone. 12 to 140 meters (40-460 ft) thick, thickening northwestward.

Jcl

Lower member (Paria River and older equivalents): Dense, even-bedded marine limestone and brown and red sandstone and calcareous siltstone forming a series of cliffs and recesses; loses most limestone beds southeastward, reverting to light-gray, light-brown, fine-grained sandstone, in medium to thick flat beds. 15 to 75 meters (50-245 ft) thick, thickening northwestward.

Jp

Page Sandstone: Light-brown and light-gray sandstone, thick bedded to massive, fine to medium grained, generally cliffy, lies unconformably on Navajo cross-beds; locally stained yellow, red, and dark brown by limonite; forms scabs on the Navajo Sandstone; grades upward into the lower member of the Carmel Formation in the northwest part of the quadrangle. 0 to 13 meters (0-40 ft.) thick; mapped only where thick enough, otherwise included with Navajo Sandstone. Bajocian (Middle Jurassic).

J-2 unconformity

Jgc

Glen Canyon Group (only on cross sections): Consists of Navajo, Kayenta, and Wingate Formations as described below; these units have characteristic colors, but in the San Rafael Swell they are commonly bleached or altered mostly to yellow-gray due to the presence or former presence of hydrocarbons; on cross sections includes the Page Sandstone.

Jn
Jnl
Jn

Navajo Sandstone: Mostly light-hued, fine- to medium-grained, cross-bedded sandstone in large trough sets; clean and friable; mostly massive; lower third commonly weathers to cliffs, the remainder into domes and rounded knolls; locally contains thin, hard, lenticular, gray limestone beds as much as 5 meters (15 ft.) thick (Jnl). 135 to 200 meters (400-650 ft.) thick, increasing from east to west. Lower Jurassic.

Jk

Kayenta Formation: Lavender, red-brown, and pale-red, medium- to thick- bedded and massive, irregularly bedded and cross-bedded (mostly low-angle), fine- to coarse-grained sandstone; thin red-brown shaly siltstone forms local partings; contains local white and dark-brown beds, intraformational conglomerate, lenses of gritstone, pebble conglomerate, and limestone; many sandstone beds are micaceous; lower contact is a scoured surface in the Wingate Sandstone; forms a series of thick steplike ledges, cliffs, and benches; mostly fluvial, but contains a few eolian beds toward the top. Mostly 45 to 90 meters (150 to 300 ft.) thick. Lower Jurassic.

Jw
TJw

Wingate Sandstone: Orange-brown, dark-brown-weathering, fine-grained, massive, eolian, quartzose sandstone; forms vertical cliffs along canyon walls, commonly stained with manganese oxide (desert varnish); local partings of sandy siltstone, more common near the base; generally well cemented with calcium carbonate, but is locally siliceous; contact with unit below is generally abrupt and placed at the base of the Wingate cliff. 73 to 130 meters (240 to 420 ft.) thick. Lower Jurassic. Labelled TJw where brecciated and recemented during collapse of assumed Tertiary age at Temple Mountain.

J-0 unconformity

Triassic Rocks

TR

Triassic rocks (shown on cross sections only): Consists of Chinle and Moenkopi Formations and their members as described below; these units have characteristic colors, but in the San Rafael Swell they are commonly bleached or altered mostly to yellow-gray due to the presence or former presence of hydrocarbons.

TRc
TTRc

Chinle Formation: TRcu and TRcm, undivided- mapped in Labyrinth Canyon and along part of the San Rafael Reef near Greasewood Draw. Labelled TTRc where brecciated and recemented during collapse of assumed Tertiary age at Temple Mountain.

TRcu

Upper Chinle member: Series of green-gray sandstone, micaceous red-brown sandstone, variegated marls, limestone and limestone conglomerates, and maroon shale; all very lenticular and interfingering; sandstone is mostly silty to fine-grained, but locally is gritty and pebbly; bedding is thin to medium or indistinct;

sandstone locally contains shale pellets and silicified wood; generally overall red-brown in upper half and green- gray in lower half; cementation is mostly calcareous or argillaceous; forms steep slope interrupted by slight ribs, ledges, and small cliffs; mostly fluvial, locally lacustrine; intertongues with Moss Back Member below. 40 to 80 meters (130-265 ft) thick in San Rafael Swell and west of the Swell; 73 to 113 meters (240-370 ft) thick in the San Rafael Desert, thickening north to south. Probably Carnian and Norian (Upper Triassic).

Ŧcm

Lower Chinle or Moss Back, Monitor Butte, and Temple Mountain, Members, undivided: Moss Back Member overlies Monitor Butte, Temple Mountain, and locally the Moody Canyon Member of the Moenkopi Formation unconformably; overall gray or gray brown interfingering sequence of cliff- and bench-forming quartzose pebble conglomerate; fine- to medium-grained massive sandstone, limestone pebble conglomerate, fine-grained platy weathering sandstone, and minor gray mudstone; these units interfinger and intergrade; one or more may be locally absent; contains scattered fragments and logs of petrified wood, especially near the top and bottom; contains clay galls, pellets, and carbonized wood near the base, some of which is uraniferous and cupriferous; calcareous cementation; beds are cross-bedded (low angle), lenticular, and weather platy toward the top; fluvial deposit; member thickens where it is channeled into units below. Temple Mountain and Monitor Butte Members locally intergrade and interlens; Temple Mountain consists mostly of mottled (mostly purple, white, and yellow) indistinct to massive siltstone and sandstone (paleosols); Monitor Butte contains less massive siltstone beds and lenses of medium- to coarse-grained quartzose sandstone. Combined lower member is 0 to 52 meters (0-170 ft) thick; Moss Back is 0 to 45 meters (0-150 ft) thick; combined Temple Mountain and Monitor Butte Members are 0 to 20 meters (0-66 ft) thick; in San Rafael Swell the lower members are mostly 3.5 to 52 meters (12-170 ft) thick; and under the San Rafael Desert and in Labyrinth Canyon the lower members mostly range from 0 to 23 meters (0-75 ft) in thickness.

Ŧ3 u

Ŧmu	Ŧm
Ŧml	

Moenkopi Formation, undivided: Mapped as such along a small part of the San Rafael Reef. Ŧmu (upper Moenkopi) is the Moody Canyon and Torrey Members, undivided. Ŧml (lower Moenkopi) is the Sinbad Limestone and Black Dragon Members, undivided. In Labyrinth Canyon Ŧm carries the same description as the Moody Canyon Member in the San Rafael Swell.

Ŧmm

Moody Canyon Member: Red-brown, chocolate-brown, fine-grained sandstone and siltstone; in even thin beds with local medium beds; forms steep slope with subtle ribs and a few ledges near the top; gradational and intertonguing with Torrey Member below, but Torrey generally does not participate in forming the steep slope beneath the lower Chinle cliff; locally contains thin veinlets of cross-cutting satin spar gypsum. 43 to 76 meters (140-250 ft) thick. Scythian and Anisian (Lower and Middle Triassic).

Ŧmt

Torrey Member: Altered green-gray and yellow-gray, locally red-brown, locally banded yellow-gray and red-brown, thin- to medium-bedded, shaly siltstone and very fine-grained sandstone; forms alternating slopes and cliffy ledges; slopes are generally earthy weathering, ledges platy and slabby weathering; ripple marked; locally petroliferous. 90 to 130 meters (300-420 ft) thick. Scythian (Lower Triassic).

Ŧms

Sinbad Limestone Member: Medium- and yellow-gray limestone and calcareous sandstone with a few thin shaly siltstone partings; thin to medium bedded; hard, ledge and bench forming; generally contains fine-grained sand-sized fossil particles and bivalve outlines; locally stylolitic and oolitic; weathers hackly; locally petroliferous; marine deposit. 0 to 45 meters (0-150 ft) thick; thins eastward and is buried in Labyrinth Canyon. Scythian (Lower Triassic).

Ŧmb

Black Dragon Member: Mostly green-gray or yellow-gray, thin- to medium-bedded siltstone, fine-grained sandstone, and mudstone; forms a steep slope beneath the Sinbad Limestone Member; local chert conglomerate at the base; locally dark-gray due to hydrocarbon saturation. 20 to 60 meters (65-200 ft) thick. Scythian (Lower Triassic).

Ŧ1 unconformity

Permian Rocks

P

Permian rocks, undivided (shown on cross sections only): Descriptions of individual formations as follows:

Pk

Kaibab Limestone: Blocky light-gray to cream-colored, locally oolitic, cherty dolomite and limestone, overlying yellow-gray to gray sandstone; generally forms an upper ledge (dolomite and blocky sandstone) and a lower slope (earthy weathering sandstone); locally missing along axis of the San Rafael Swell; contains small chert, quartz, and calcitic geodes locally filled with oil; locally fossiliferous, marine deposit; locally has a sandy, light-brown thin-bedded limestone at the base that reflects a reworking of the underlying Cedar Mesa Sandstone. 0 to 26 meters (0-85 ft) thick. Leonardian (Lower Permian).

Pwc

White Rim and Cedar Mesa Sandstones, undifferentiated: Massive, eolian cross-bedded, light-gray, brown, yellow-gray, and light-brown sandstone; medium to coarse-grained; calcareous; locally blotched irregularly with red and brown patches, generally cliff-forming, erodes into deep canyons; locally limonitic or hematitic. 150 to 290 meters (500-950 ft) thick as exposed in the San Rafael Swell and as determined in nearby drill holes; to east under the San Rafael Desert, drill holes indicate about 90 meters (300 ft) of White Rim Sandstone overlying 150 meters (500 ft) of Organ Rock Shale and Cedar Mesa Sandstone. Wolfcampian and Leonardian (Lower Permian).

Pp

Pakoon Dolomite: Pink dolomite, light-gray dolomitic sandstone, light-brown, red, fine-grained sandstone, and limestone; mostly in thin to thick blocky beds; locally cherty; weathers to medium brown in outcrop; forms hackly, blocky ledges and intervening slopes. About 90 meters (300 ft) thick in Eardley (Straight) Canyon; 90 to 245 meters (300-800 ft) thick where identified as Lower Permian carbonates in San Rafael Desert drill holes. Wolfcampian (Lower Permian).

unconformity

Pennsylvanian? Rocks

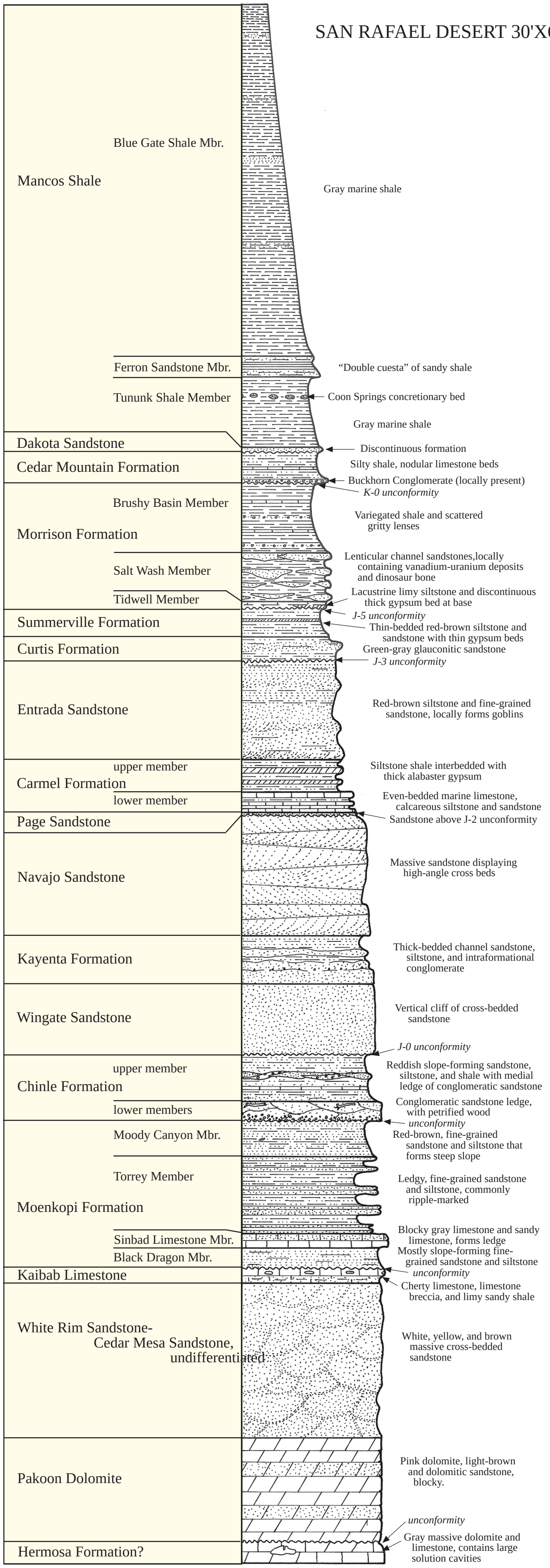
IPh?

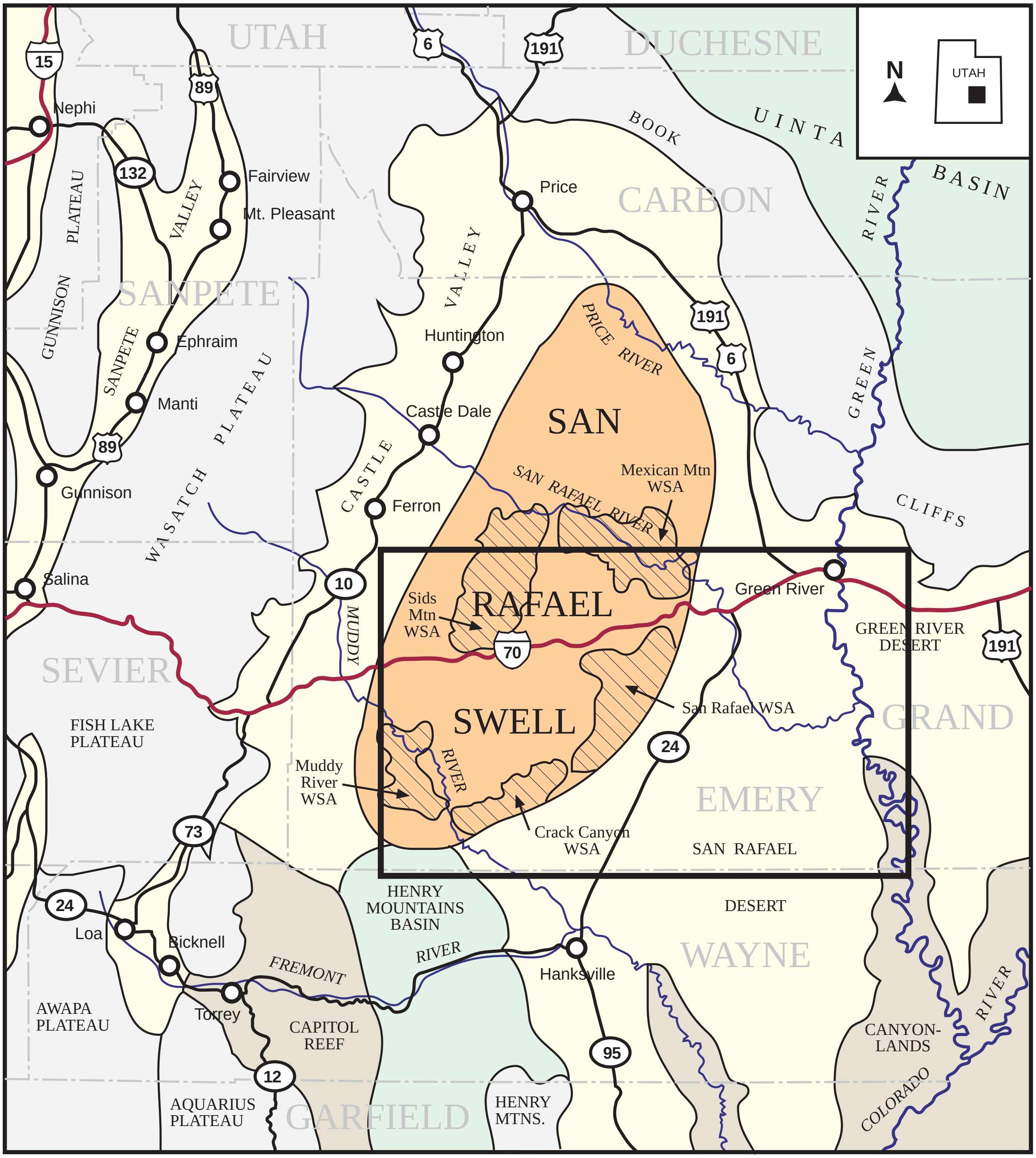
Hermosa Formation?: Light-gray to pink limestone and dolomite; locally incorporated are large angular fragments of limestone and dolomite; locally contains pebbles and sand; massive cliff former; contains large solution cavities (incipient sink holes) as much as 3 meters (10 ft) across; weathers hackly. Incomplete section of 32+ meters (105+ ft) exposed at bottom of Eardley Canyon. Pinches out westward on Emery High, thickens eastward into Paradox basin as Honaker Trail Formation (Welsh and Bissell, 1979); however, if Emery High extends this far east, this unit may be the Mississippian Redwall Limestone. Not shown on cross sections.

System	Series	Formation	Member		Map Units	X-sections	Other places	
T.	Miocene	Lamproite dikes			Td			
CRETACEOUS	Upper	Mancos Shale	Blue Gate Shale Mbr.		Kmb	Km		
			Ferron Sandstone Mbr.	upper part	Kmfu			
				lower part	Kmfl			
			Tununk Shale Member	Coon Springs bed	Kmtc			
					Kmt			
		Dakota Sandstone			Kd	Kdcm		
	unconformity							
	Lower	Cedar Mountain Formation			Kcm			
unconformity								
JURASSIC	Upper	Morrison Formation	Brushy Basin Member		Jmb	Jm		
			Salt Wash Member		Jms			
			Tidwell Member		Jmt			
	J-5 unconformity							
	Middle	Summerville Formation			Js	Jsr		
		Curtis Formation			Jct			
		J-3 unconformity						
		Entrada Sandstone	Earthy Member	undivided	Jee		Je	
			Slick Rock Member		Jes			
		Carmel Formation	Upper Member	undivided	Jcu		Jc	
			Lower Member		Jcl			
		Page Sandstone			Jp	Jgc		
	J-2 unconformity							
	Lower	Navajo Sandstone		limestone beds	Jn / Jnl			
		Kayenta Formation			Jk			
		Wingate Sandstone			Jw			
J-0 unconformity								
TRIASSIC	Upper	Chinle Formation	Upper Member		Ꞧcu	Ꞧ	Ꞧc	
			Moss Back Member		Ꞧcm			
	unconformity							
	Lower	Moenkopi Formation	Moody Canyon Mbr.	undivided / undivided	Ꞧmm		Ꞧmu	Ꞧm
			Torrey Member		Ꞧmt			
			Sinbad Limestone Member		Ꞧms		Ꞧml	
			Black Dragon Member		Ꞧmb			
unconformity								
PERMIAN	Lower	Kaibab Limestone			Pk	P		
		White Rim and Cedar Mesa Sandstones			Pwc			
		Pakoon Dolomite			Pp			
unconformity								
PENN.	Upper	Hermosa Formation?			IPh?			

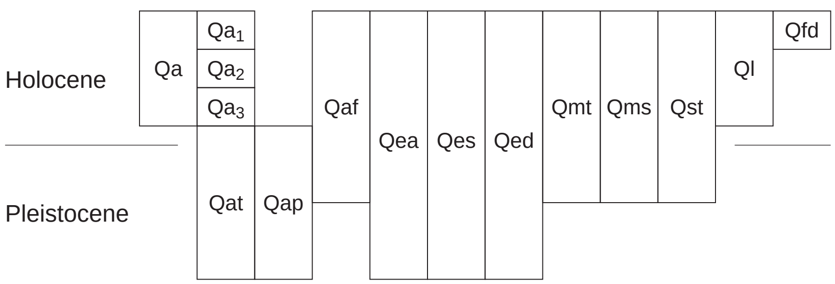
CORRELATION OF BEDROCK MAP UNITS

SAN RAFAEL DESERT 30'X60' QUADRANGLE 7/02





Index map to the San Rafael Swell and surrounding physiographic features. Heavy black line outlines San Rafael Desert 30' x 60' quadrangle. Five (5) wilderness study areas (WSAs) cover parts of the San Rafael Swell.



Correlation of Quaternary units
on the San Rafael Desert 30’ x 60’ quadrangle

Explanation of Map Symbols

San Rafael Desert 30'x60' Quadrangle

Contact – dashed where approximately located

Normal fault – dashed where approximately located, dotted where concealed, bar and ball on down-thrown side

Anticlinal axis – dashed where approximately located, dotted where concealed, arrow on axis indicates direction of plunge

Synclinal axis – dashed where approximately located, dotted where concealed, arrow on axis indicates direction of plunge

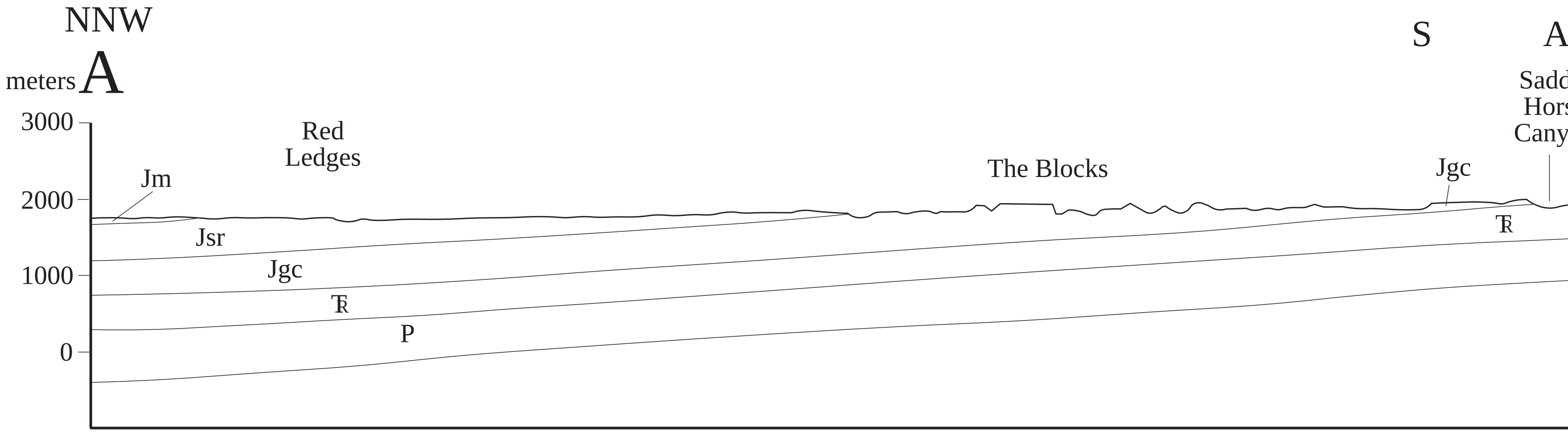
Major joint – near vertical (only major joints mapped individually)

1350 Structural contour – datum in center of San Rafael Swell is top of Chinle Formation (purple), west and east of Swell is Navajo Sandstone (red); 50 meter contour interval.

A A' Cross section line

3 Strike and dip of strata

Qea/Qes Indicates thin cover of first unit overlying second unit


NNW
meters A
3000
2000
1000
0
Red Ledges
Jm
Jsr
Jgc
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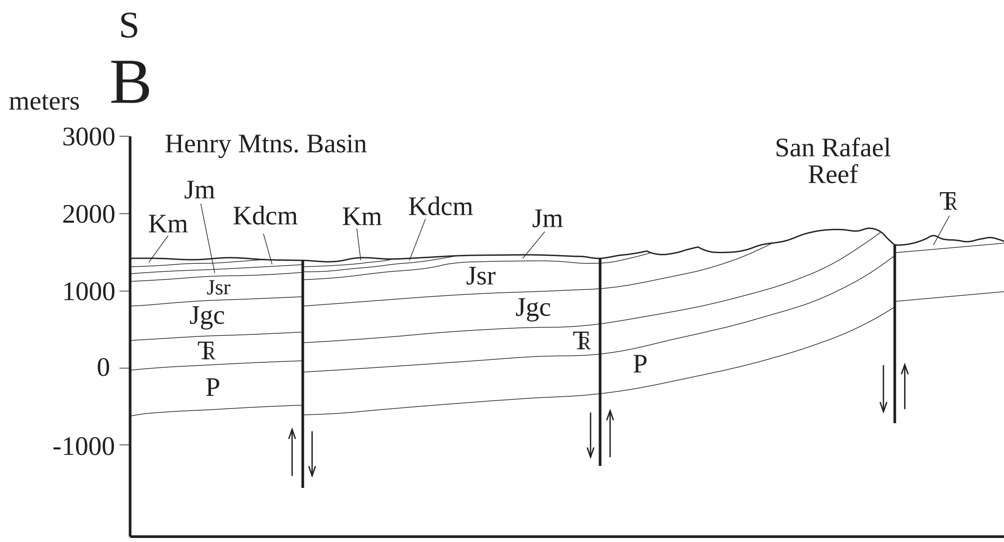
P
The Blocks
S
A
Jgc
Ꞧ
Sadd
Hors
Cany


S
meters B
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2000
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0
-1000
Henry Mtns. Basin
Jm
Km
Kdcm
Km
Kdcm
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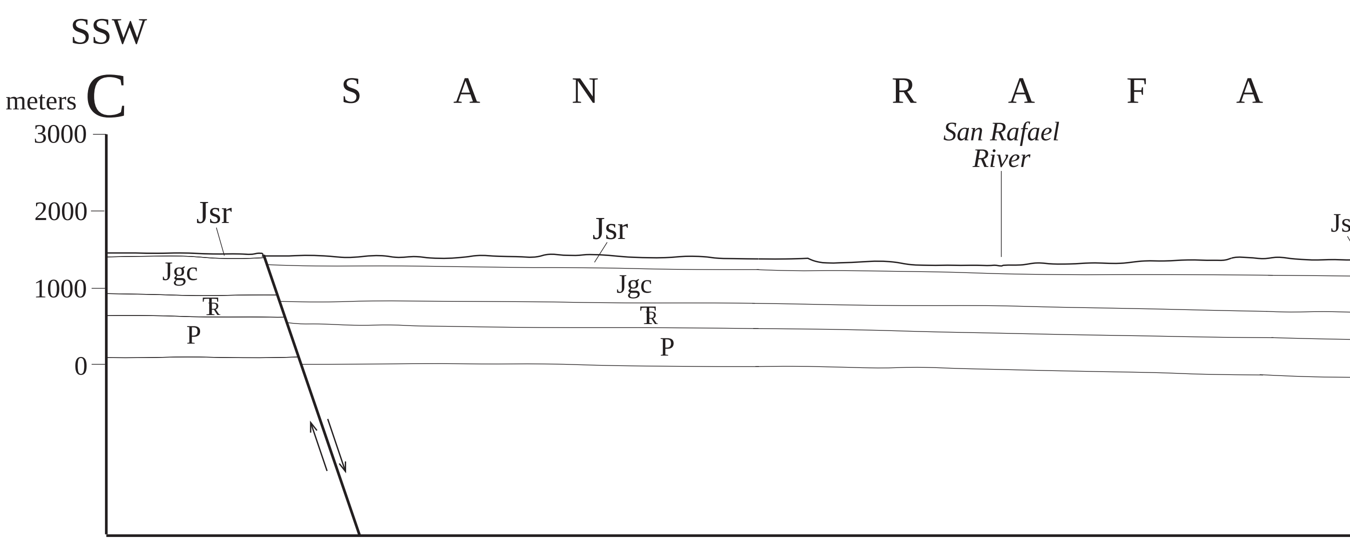
P
San Rafael Reef
Ꞧ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S A N R A F A
San Rafael River
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Jsr
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Jgc
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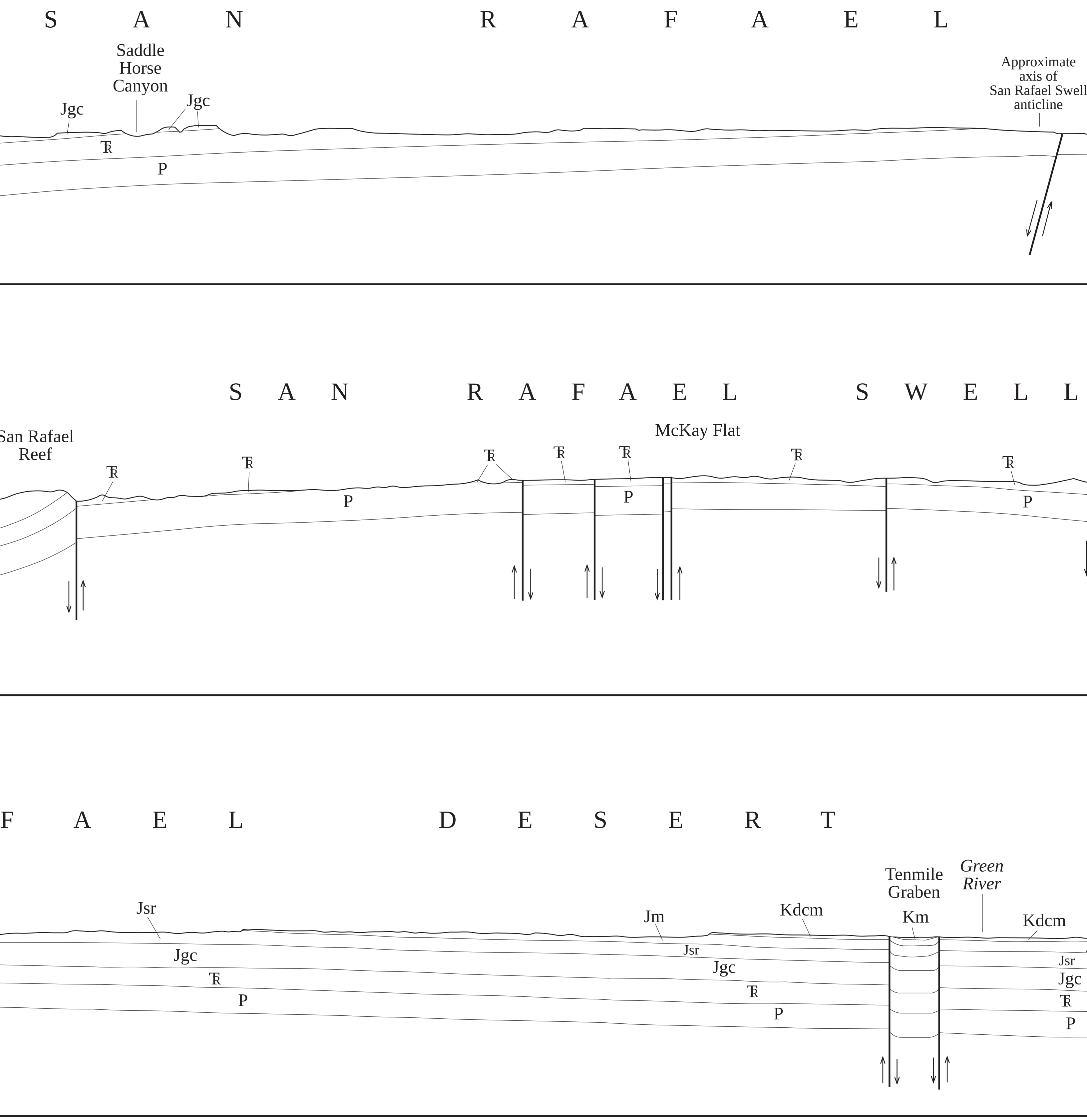
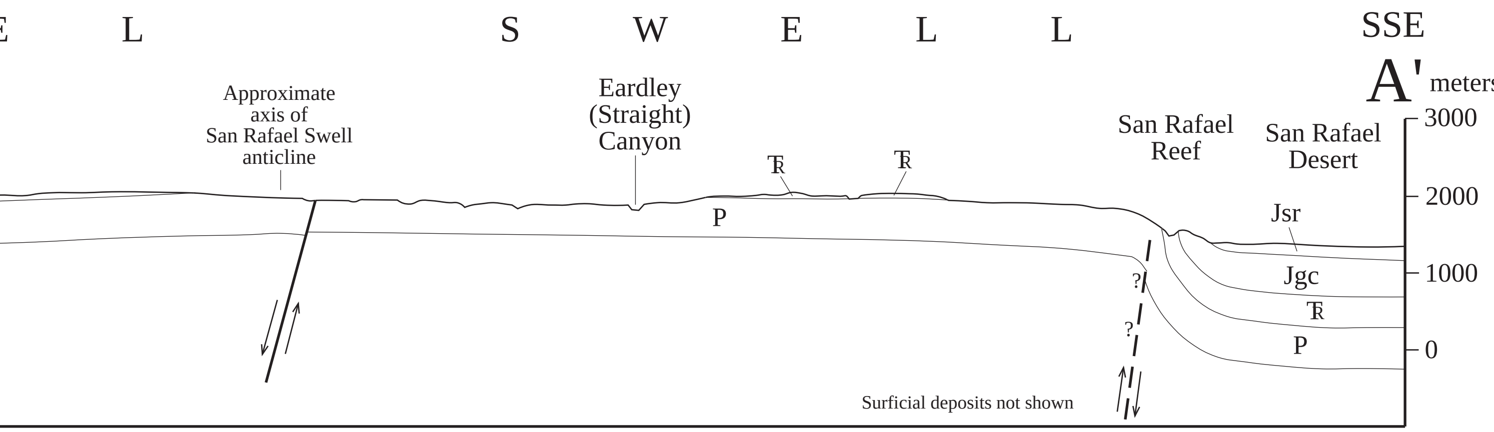
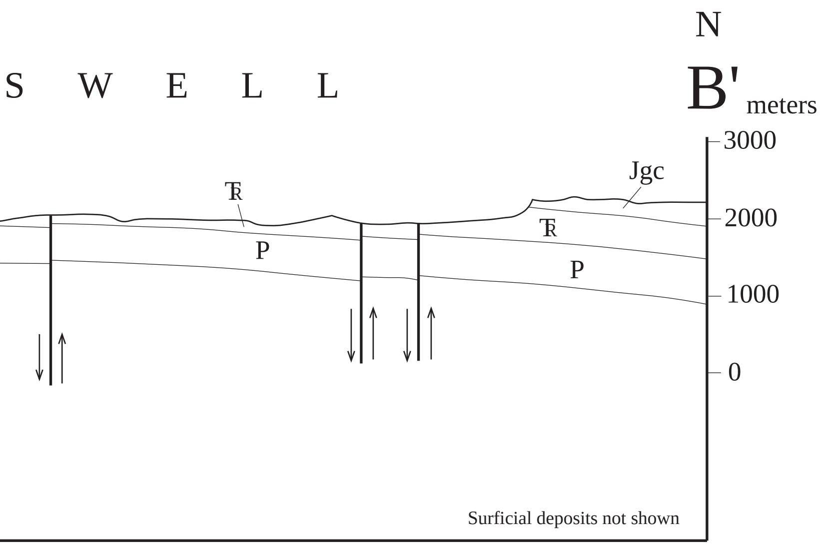
P
P



S A N R A F A E L
Saddle Horse Canyon
Jgc
Jgc
TR
P
Approximate axis of San Rafael Swell anticline
S A N R A F A E L S W E L L
San Rafael Reef
McKay Flat
TR
TR
TR
TR
TR
TR
TR
P
P
P
F A E L D E S E R T
Jsr
Jgc
TR
P
Jm
Jsr
Jgc
TR
P
Kdcm
Tenmile Graben
Km
Green River
Kdcm
Jsr
Jgc
TR
P


E L S W E L L
SSE
A'
meters
3000
2000
1000
0
Approximate axis of San Rafael Swell anticline
Eardley (Straight) Canyon
T̵R
T̵R
P
San Rafael Reef
San Rafael Desert
Jsr
Jgc
T̵R
P
?
?
Surficial deposits not shown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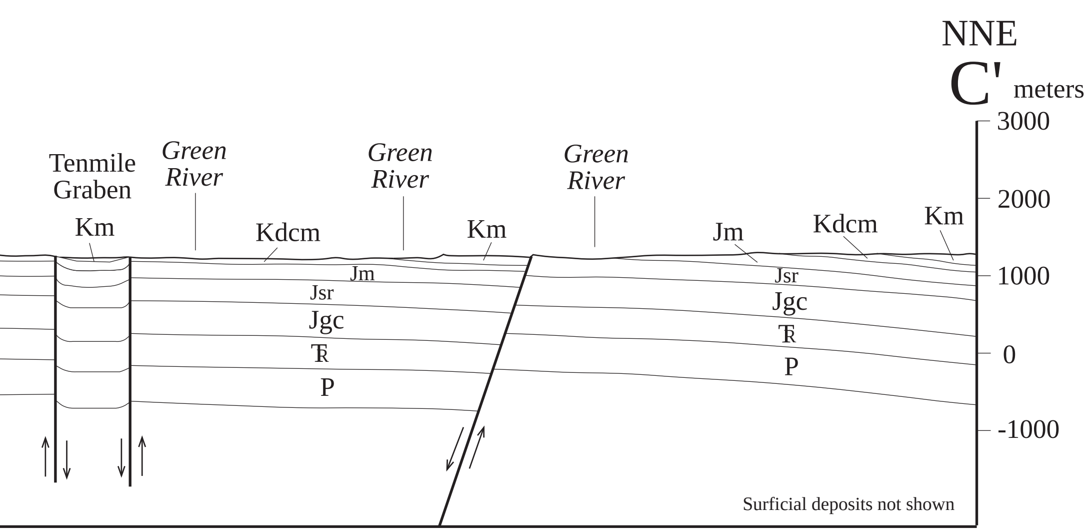
Surficial deposits not shown


NNE
C'
meters
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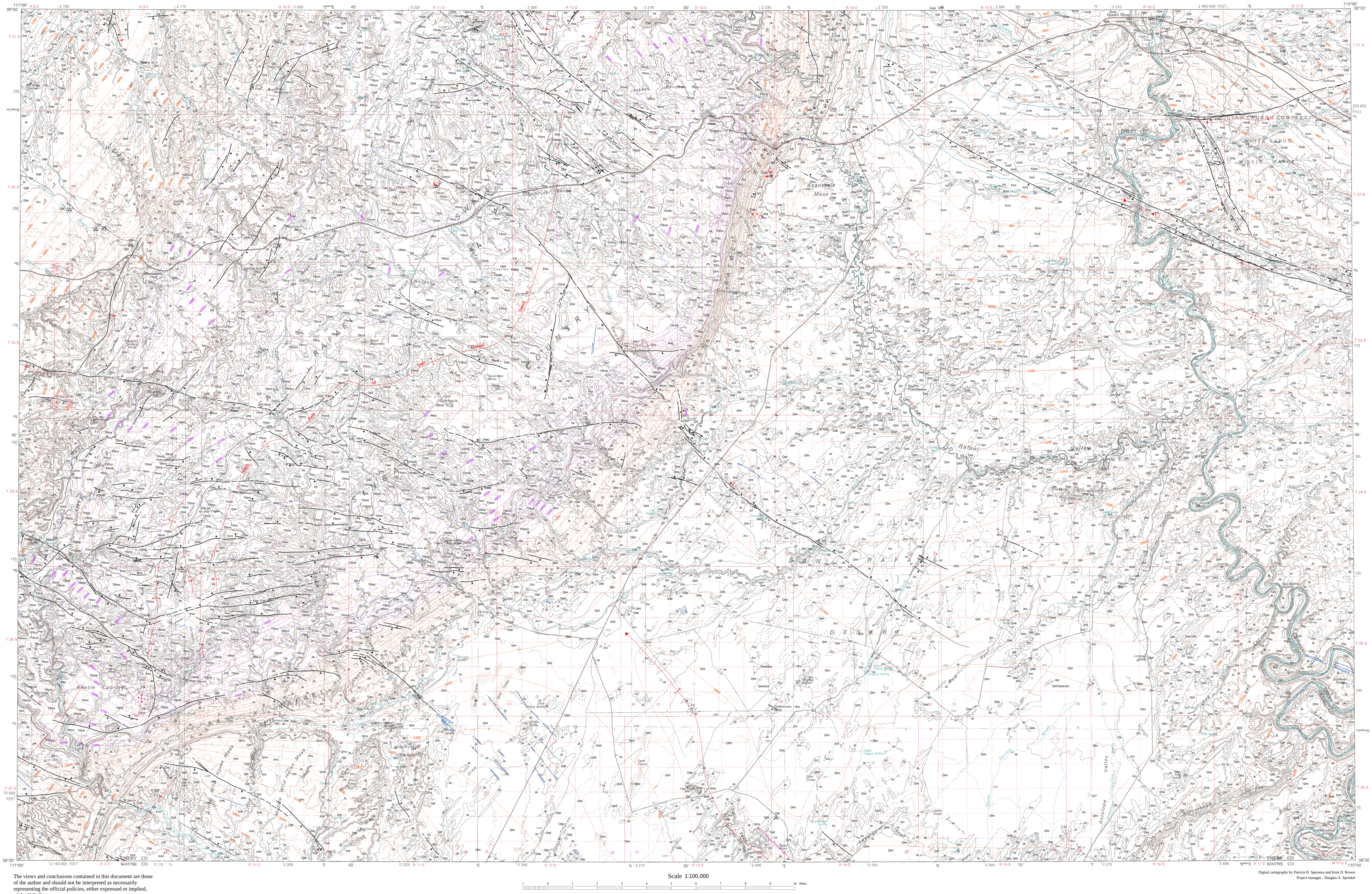
2000
1000
0
-1000
Tenmile Graben
Km
Green River
Kdcm
Green River
Km
Green River
Jm
Kdcm
Km
Jm
Jsr
Jgc
T̵R
P
Jsr
Jgc
T̵R
P
Surficial deposits not shown

Utah Geological Survey
a division of
Utah Department of Natural Resources
in cooperation with
U.S. Geological Survey
STATEMAP Agreements 01HQAG0100, 00HQAG0109, and 99HQAG0138

Plate 1
Utah Geological Survey Open-File Report 404
Interim Geologic Map of the San Rafael Desert Quadrangle



Scale 1:100,000

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Digital cartography by Patricia H. Speranza and Kent D. Brown
Project manager - Douglas A. Sprinkel

Interim Geologic Map of the San Rafael Desert Quadrangle, Emery and Grand Counties, Utah

by
Hellmut H. Doelling

2002